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Gordon W. Gullion

MANAGEMENT OF ASPEN FOR RUFFED GROUSE AND OTHER WILDLIFE - AN UPDATE

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ABSTRACT.-- The aspens (Populus tremuloides; P. grandidentata) are the basic habitat resource for ruffed grouse (Bonasa umbellus) across the major portion of this bird's North American range. The occurrence and welfare of these birds is closely associated with the presence and condition of aspen stands. The aspens provide critical food and cover for these grouse, and this has permitted the development of specific guidelines for forest managers to use to maintain or improve habitats for these birds. But continuing research and the recent identification of a feeding deterrent, coniferyl benzoate, in the male flower-bud has necessitated some changes in recommendations relative to the maintenance of winter food resources. The cover requirements of ruffed grouse have become well defined and predicted responses have resulted from prescribed aspen clearcutting. The best quality of cover is provided by aspen saplings 5- to 25-years old with densities in the range of 3,000 to 8,000 stems/acre. The most productive size of treatment has been 1-acre blocks, but 10-acre blocks of aspen regeneration support breeding grouse densities in excess of 10 pairs/100 acres, a density more than 10-fold greater than in nearby >50-year-old northern hardwood forests. Precommercial thinning may or may not have a detrimental impact on subsequent grouse abundance. This effect will probably depend upon the understory shrub response to the thinning. The forest manager has the opportunity to rather precisely determine how many breeding grouse will live in areas under his or her control by the management prescriptions involving the maintenance of aspen.

At the 1972 Aspen Symposium here in Duluth I identified the aspens as being the basic habitat resource for ruffed grouse across the major portion of their range (Gullion and Svoboda 1972). At that time it was a novel idea and not widely accepted (some authors still don't accept it - see Bergerud and Gratson 1988:691). But other studies underway at that time (Rusch and Keith 1971, Doerr et al. 1974), or initiated subsequently (Huemphner 1981) have reinforced the validity of my original position.

I don't believe it is coincidence that by far the greatest abundance of ruffed grouse is in North American forests where aspen is a part of the forest composition. While these grouse also live in some areas where aspen is not present, these are almost entirely areas where winter snow cover is not persistent. Also, densities of breeding grouse in regions extralimital to the range of aspen tend to be only a fraction of the densities in areas where aspen is present, especially in interspersed age-classes (Table 1).

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Table 1.--Representative ruffed grouse densities as related to the occurrence of aspen in the forest composition.

Area	Density/ 100 Acres[1]	Forest Composition	Reference
		Aspen Regeneration	
Michigan - Gladwin Refuge	10 - 13	5-15 year-old aspen	Prawdzik (unpublished)
Minnesota - Cloquet Forest	9.3	10-25 year-old regen.	Gullion & Alm (1983)
Mille Lacs WMA	8.0 - 15.3	5-15 year-old aspen	Gullion (1989)[2]
Wisconsin - Sandhill WMA	6.8	Aspen regen. w/alder	Kubisiak et al. (1980)
		Mature Aspen Present	
Alberta, Canada	1.8 - 4.1	Spruce-aspen	Boag (1976)
Alberta, Canada	5 - 9	Mature aspen	Rusch & Keith (1971)
B.C., Canada	3.2 - 4.2	Mixed aspen-Douglas-fir	Davies & Bergerud (1988)
Idaho	2.8	>80 year-old aspen	Stauffer & Peterson (1985)
Michigan - Midland	0.9 - 2.1	Mature aspen-hardwood	Haufler (1989)[2]
Minnesota- Mille Lacs WMA	0.7	Northern hardwood	Gullion (1989)[2]
Ohio	0.8 - 1.8	Mixed conifer-hardwood	Stoll et al. (1979)
Ontario, Canada	4.5	Mixed conifer-hardwood	Theberge &Gauthier (1982)
Pennsylvania	1.3 - 2.8	Northern hardwood	Drake (1989)[2]
Vermont	1.07	Mixed hardwood/conifer	Sousa (1978)
Wisconsin - Stone Lake	3.0	Mature aspen & balsam fir	Kubisiak et al. (1980)
		No Aspen	
Georgia	0.72 - 1.05	Oak-hickory hardwood	Hale et al. (1982)
Missouri	0.57	Mixed oak hardwood	Thompson & Fritzell (1989)
Ontario	2.9	Mixed conifer-hardwood	Theberge & Gauthier (1982)
Pennsylvania	0.8 - 1.4	Oak-hickory hardwood	Drake (1989)[2]
Tennessee- Catoosa WMA	0.15 - 0.23	Oak-hickory hardwood	Dimmick (1989)[2]
Cherokee NF	0.25 - 0.33	Oak-hickory hardwood	Dimmick (1989)[2]
Washington	2.3 - 2.6	Mixed deciduous-conifer	Brewer (1980)

[1]Based on drumming males and approximately equals breeding pairs in spring.

[2]Data extracted from unpublished progress reports submitted to The Ruffed Grouse Society.

I believe ruffed grouse have evolved in North American forested environments to take advantage of the unique characteristics of the aspens. These characteristics include fleshy, highly-palatable leaves for a summer-long food resource; a winter-long abundance of large, nutritionally-rich, staminate flower-buds set on stout twigs, which later develop into large, nutritious catkins just prior to the grouse breeding season; and a method of root-sucker regeneration that for a number of years provides secure, uncluttered, evenly-spaced vertical cover, to a degree unmatched by any other form of northern forest vegetation.

Since aspen has the widest distribution of any tree in North America, and occurs in at least 27 percent of the forested acreage on the continent (Gullion 1977, 1985), it is not surprising that ruffed grouse, by taking advantage of the aspen resource, have the widest distribution of any resident game bird on the continent. These grouse occur in Alaska, all of the Canadian provinces, and in 39 of the 48 contiguous United States.

Johnsgard (1973:257) suggests a relationship between the range of ruffed grouse and the occurrence of balsam-poplar (Populus balsamifera). These birds seldom utilize any part of this tree, and there is no biological basis for this association.

Even in localized areas there is a marked association between the distribution of aspen and the persistent occurrence of ruffed grouse. On the Cloquet Forest, 20 miles west of the site of this symposium, where aspen occurs in only about 11 percent of the forest, 87.6 percent of 210 persistently used drumming logs (by 4 or more birds or for longer than 5 years since 1956) were under or within sight of mature male aspens. Another 13 (6%) were in sapling aspen stands out-of-sight of mature aspen. On the Mille Lacs study area, 90 miles farther to the southwest, aspen comprises only about 14 percent of the hardwood forest composition, and 88 percent of the occupied drumming logs there have been under or within sight of mature aspens. Aspens were within sight of 96 percent of 138 drumming logs surveyed in Maine (Schemnitz 1976). In southeastern Ohio hardwood forests, where aspen comprises less than 1 percent of the forest stand, 53 percent of the ruffed grouse drumming logs were within 100 m (328 feet) of aspen (Stoll et al. 1979).

Huff (1973) examined in more detail the nutritive qualities of aspen flower-buds in Minnesota, as did Doerr et al. (1974) in Alberta, Canada. Huemphner (1981) provided additional, more detailed information concerning ruffed grouse foraging behavior in another Minnesota site. In a round-about way the classic New York ruffed grouse study inferred a more than casual relationship between these birds and aspen by the comment:

> The large buds, long catkins, and tough leaves set on stout twigs of the aspens (Populus) are particular favorites even when other food is abundant (Bump et al. 1947:201).

THE ROLE OF ASPEN AS FOOD

The importance of aspen as a food resource has long been recognized (Svoboda and Gullion 1972) and has been included in aspen management prescriptions since 1972 (Gullion 1972). The 1986 forest management plans for the Superior National Forest (U.S.F.S. 1986) acknowledged the importance of this resource in the specification:

> When the [aspen] harvest area is greater than 20 acres and mature aspen is not within 10 chains (660 feet) of the periphery of the stand, one clone of mature male aspen should be left standing.

In Minnesota, both at Cloquet (Svoboda and Gullion 1972) and Cedar Creek (Huemphner 1981) where both quaking and big-toothed aspen occur together ruffed grouse have shown a preference of about 2:1 for quaking over big-toothed when compared to the relative abundance of the two tree species. The male flower-bud is most often fed upon but enlarged female buds are taken occasionally.

Most of the emphasis has concerned the role of aspen flower-buds as a winter food resource. Less attention has been given to the use of the staminate catkins that elongate in early spring. As more is learned about these birds and their needs it appears that these catkins may be more important than the flower-buds as a food resource, albeit for a short period of time.

On the Minnesota study areas (Cloquet and Mille Lacs), without fail, the extended catkins have been the nearly exclusive diet of drumming male ruffed grouse (and we suspect, of females as well) for the two or three weeks in April that they are available. This statement is based on the classification of tens of thousands of droppings at more than 2,000 drumming sites over the past quarter century. Regardless of what ruffed grouse have been using all winter, and the availability of other food resources as the snow melts (especially the green leaves of frost-resistant herbs such as strawberry (Fragaria sp.), bunchberry (Cornus canadensis), gold-thread (Coptis groenlandica, etc), aspen catkins are nearly the exclusive diet for a short time. Once the pollen has been shed and the catkins dry up and begin to fall grouse turn their attention to willow catkins or the leaves of the frost-resistant forbs. As soon as aspen leaves begin to emerge many grouse begin feeding on these, with the leaves of male aspens being preferred.

Few other ruffed grouse studies have focussed on the feeding behavior of grouse at this critical season, but Stoll et al. (1980) found heavy use of aspen catkins by male ruffed grouse in southeastern Ohio where aspen is scarce.

Our continuing studies have shown that the flower-buds are not a dependable winter food resource even when physically available. As early as 1973 we realized that ruffed grouse were inconsistent in the use of aspen flower-buds, and that extent of use was not related to the annually varying abundance of buds. In some seasons ruffed grouse make almost no use of the flower-buds even when abundant on the trees. There is always a high level of selectivity in the choice of aspens to be fed in. Normally a very small percentage (<10%) of the male aspens provide an acceptable, winter-long food resource for ruffed grouse.

Bump et al. (1947) noted that variations in grouse use of aspen buds and catkins (and some other food items) was not necessarily related to their abundance and availability. They commented:

> it seems clear that changes in utilization are many times dictated not by availability, but rather by some other factor not yet apparent (p.219).

Doerr et al. (1974:609) noted that grouse use of aspen flower-buds declined sharply from the winter of 1969-70 (47 percent of crop volume) to the winter of 1970-71 (3 percent of volume), even though bud availability appeared to remain relatively constant.

But there has been unvarying, consistent use of the extended catkins in the spring, and it seemed probable to us that some substance in or on the flower bud-scales was acting as a feeding deterrent.

Recently completed research here has identified a phenol, coniferyl benzoate concentrated in the bud scales, as the apparent feeding deterrent (Jakubas 1989, Jakubas et al. 1989, Jakubas and Gullion 1989). It is suspected that periodic variations in ruffed grouse abundance (the grouse "cycles") are at least partly a consequence of periodic changes in the amount of this phenol in aspen flower-buds (Gullion 1984a). Annual variations in the amount of protein in these buds may also play a role (Jakubas 1989). Longer-term studies are needed to validate this relationship.

MODIFICATION OF EARLIER RECOMMENDATIONS

These findings indicate a need to modify some earlier recommendations concerning provision of winter-long food resources (Gullion 1984b:28). The practice of leaving small groups or clones of male aspens scattered at the rate of one every 10 to 20 acres in extensive aspen clearcuts probably will not be

effective unless several clones of male aspens are involved. This, then, means leaving patches that are probably at least one or two acres in extent, rather than a few dozen trees.

Since the amount of coniferyl benzoate in the flower-buds of individual trees fluctuates between years (Jakubas 1989), preservation of identified feeding trees is not assurance that those trees will be chemically suitable for utilization in the future. The most satisfactory provision of adequate winter-food resources, and the maintenance of ruffed grouse abundance is probably dependent upon even-area, 3- or 4-stage rotational, clearcut harvesting in dispersed blocks, not over 20 acres in size (see Gullion 1984b).

But even more important, these findings, together with the very little winter use of aspen flower-buds during most of the past decade, indicate the need to maintain ample, alternative winter food resources for ruffed grouse. In northern Minnesota hazel (Corylus sp.) is the most important of these alternative resources, with birch (Betula sp.) of secondary importance. Elsewhere, in the range of aspen, ironwood or hophornbeam (Ostrya virginiana) may replace hazel in importance. The 3- or 4-stage rotational harvesting described earlier will usually meet this need for adequate alternative food resources.

We now regard alder (Alnus sp.) to be virtually useless as a grouse food. Most other widely used food materials are either too uncommon or only seasonally available in aspen forests, and not dependable over a wide area on a winter-long basis. This includes the roses (Rosa sp.), cherries (Prunus sp.), juneberry (Amelanchier sp.), mountain ash (Sorbus sp.), blueberries (Vaccinium sp.), and a few others.

ASPENS AS GROUSE COVER

At the time of the 1972 Aspen Symposium we had only begun to appreciate the role aspen plays as year-around cover for ruffed grouse. Subsequently this role has become very apparent and the parameters of premium grouse cover have become well defined (Cade and Sousa 1986). Research spanning more than 30 years has documented these relationships. This has involved observing the use, abandonment, reuse and abandonment again of forest tracts that have been clearcut. These are stands that were allowed to regenerate to aspen, and watched as the aspen stand developed through a period when it supported high density ruffed grouse populations (as high as reported anywhere on the continent), which eventually declined as the aspen stand became too old and open.

Aspen regeneration is most useful as grouse cover from the time it thins to about 8,000 stems/acre, until natural thinning brings the density below about 3,000 stems/acre (Gullion 1984b, Cade & Sousa 1986).

The timing of this usefulness depends upon at least two factors, one environmental and one a management decision. On the poorer soils on the Cloquet Forest satisfactory densities develop about 10 years following harvesting. Then about 15 years later the lower density threshold is reached at which grouse abandon aspen stands.

On heavier soils and a warmer climate at Mille Lacs, but under the same management regimen, aspen stands are commonly in use by 5 or 6 years after harvesting. But in another 10 years they have thinned too much and "gone-by" when they are about 15 years old. This same timing occurred in aspen regeneration areas on the Gladwin Refuge on Michigan's Lower Peninsula (Prawdzik, unpubl. data).

The management decisions that can affect this sequence are mostly related to age of the stand when harvested and season of harvesting, and relationships between these two factors.

Ideal aspen sucker regeneration should initially exceed 12,000 stems/acre. This assures highly competitive growth, resulting in the saplings concentrating growth in the terminal tips. These saplings

grow straight with minimal lateral branching. Sufficient height, usually at least 18 feet, is also an important factor governing grouse use of aspen regeneration.

Aspen stem densities do not have to be uniform over an entire area, so long as there is at least an acre of adequate stem density for each 8 to 10 acres of regeneration. One such block of cover should be present wherever a pair of breeding grouse is desired.

EFFECT OF TREATMENT SIZE

The best overall habitats for ruffed grouse are those in which the year-long needs for food and cover are obtained with the least amount of movement. Movement is expensive, both in the use of energy and the increased exposure to predation. On the other hand, social interactions limit the numbers of grouse that can be supported in one area. Each adult male requires 6 to 8 acres for his exclusive territory, with hens content to use the territories of 2 or 3 males for their winter ranges.

On the Mille Lacs area a major effort has been directed towards determining the most productive harvesting configurations from the standpoint of grouse response. Based on 20 years of experience, 1-acre clearcuts with good aspen regeneration have provided the highest response/acre cut. A series of 1-acre cuts made in 1968 to 1973 were being used at the rate of 1 breeding male/2.3 acres cut by 1977 (Gullion 1983).

By contrast, of 32 clearcuts less than 1-acre in size made at the same time, only 5 have been used by breeding grouse. There seems to be a 1-acre size threshold that must be reached or exceeded before a clearcut will become an acceptable covert for ruffed grouse winter and breeding season use.

Since 1974 we have cut about 716 acres on 67 parcels varying from 5 to 40 acres in size. Some of these were cut as strips 5 chains wide and 20 chains long (330 x 1320 feet), the others in as nearly square blocks as topography would allow. Table 2 shows the current grouse response to these differing treatments. Within the last 5 years we have also made 52 2-1/2 acre clearcuts on one 305-acre tract. But it is too early to expect response to this treatment.

Table 2.--Densities of breeding male ruffed grouse - Mille Lacs.

Treatment	Acreage[1]	No. Birds		Density/100 Acres	
		1988	1989	1988	1989
10-Acre Blocks	129	14	17	10.9	13.2
10-Acre Strips	259	13	11	5.0	4.2
Blocks exceeding 20	103	9	13	8.7	12.6
Acres					
Uncut Forest[2]	412	3	3	0.7	0.7

[1]Based on regenerated aspen coverts logged between 1974 and 1978, and currently at the optimum stage of development. More recent cuttings where the vegetation has not reached proper density are not included.

[2]A reserved area of >50 year-old forest that supported 14 male grouse (= pairs) in 1971.

Ruffed grouse response to this management has not been as expected, with the blocks receiving considerably heavier use than the 10-acre strips (see Gullion 1984b:24). The Mille Lacs WMA is subjected to exceptionally heavy fall hunting pressure and the area cut in strips is more heavily hunted than that cut in blocks (Gullion 1988). So the effect of hunting may be obscuring the level of response that would occur in areas with lighter hunting pressure.

INTEGRATION OF GROUSE BENEFITS INTO CONIFER PLANTATIONS

Generally coniferous cover is detrimental to ruffed grouse in northern forested environments. Tables 1 and 2 show that breeding grouse densities are generally lower where coniferous cover is present than where aspen is present but conifers absent.

Recent observations at Cloquet have shown that 1- to 2-acre pockets of aspen scattered in a conifer plantation can provide highly acceptable habitat for ruffed grouse. This has been associated with the establishment of a red and jack pine (Pinus resinosa; P. Banksiana) plantation on a 48-acre site clearcut in 1969. Small pockets of aspen regeneration developed on the periphery of this plantation, and in 1984 ruffed grouse began using these aspen sites. By 1989, 9 males were using this area and an adjacent 7.4-acre 32-year-old pine plantation (having much aspen mixed through it). This density of 14.4 males/100 acres is about as many breeding grouse as reported anywhere (see Table 1), and is probably about 4 to 6 times the density of breeding ruffed grouse in most northern Minnesota forested areas.

These discrete pockets of relatively pure aspen appear to be more useful than having aspen scattered throughout a pine plantation. At Cloquet where the latter condition prevails maximum concurrent grouse densities have remained at about one-third the densities attained where these aspen pockets provide cover.

The delayed occupation of these aspen sites (at 14 years after treatment rather than the usually expected 10 years) evidently resulted from the absence of readily available, catkin-producing male aspens within a close proximity. Grouse use was delayed until the young aspens growing on the site commenced producing catkins.

The forest manager intending to integrate grouse coverts into conifer plantation sites can establish the density of birds to be supported by deciding how many 1-acre blocks of aspen regeneration are to be left in the affected area. One block per 10-acres is probably about the maximum desirable, due to the social intolerance of these birds. But in 1989 we had 4 males (all trapped and banded) sharing one area of less than 10 acres.

This high density breeding grouse population has been maintained within 1/2-mile of an active goshawk (Accipiter gentilis) nest throughout this period. In 1988 one 5-year-old and two 2-year-old grouse were in this group, and two 2-year-olds were present in 1989.

NON-GAME WILDLIFE

Most of my attention has been given to ruffed grouse-aspen relationships. Due to their multiple uses of aspen, resulting in a need for access to more than one age class, it is more difficult to meet the needs of ruffed grouse than that of any other species of wildlife living among the aspens. Among the wildlife using aspen, ruffed grouse are the last to respond to management designed for their benefit.

A study of song-bird response to aspen management for ruffed grouse at Mille Lacs showed that 16 to 24 species used 2- to 5-year-old regeneration, in contrast to 15 species in unharvested, old, northern hardwood forest (Back 1982). Breeding male song-bird densities were 1.3 to 2.5 times greater in the regeneration than in the old forest. Three years later Fouchi found 21 to 26 species of songbirds in

some of the same regeneration plots studied by Back, and 23 species in the old, uncut forest (Fouchi and Gullion 1984). Back (1982) found the greatest species diversity in the 10-acre clearcuts. But all the species found in the larger clearcuts were found in one or more of the 1-acre clearings.

MANAGEMENT CONFLICTS AND CONSTRAINTS

Providing adequate interspersion of age classes is probably the most serious aspen management problem to be confronted where and when ruffed grouse are included as an important benefit. Maximum ruffed grouse densities will be found where at least 1 acre in every 10 is in a young pole stage (2-5" dbh) at densities of 3000 to 8000 stems/acre. This optimum density stand should be within 100 yards of mature, male, catkin-producing aspens.

The best way to achieve this is by harvesting aspen every 10-12 years in small blocks (<10 acres), rotating around a common corner. Any other program or design will result in a hiatus in grouse use until the proper density of young aspen becomes available again.

Elsewhere, in a concurrent session at this symposium, the thinning of aspen to improve its growth is being discussed. Since proper stem densities are a critical factor governing ruffed grouse use of aspen stands, treatments that alter these densities will impact upon ruffed grouse numbers.

Perala (1978) has suggested thinning 10-year-old stands to densities of 2,000 or fewer stems/acre (with 550/acre an optimum density) which would reduce the value of the aspen stand as cover for ruffed grouse. But the thinned stand should retain its value as a source of food. If the thinning resulted in substantially increased understory shrub growth (mostly hazel and/or alder) that stand would be improved as year-long habitat for ruffed grouse since it would provide sufficient cover under aspen that would be producing a winter-long food resource about 14 years after stand regeneration. This treatment may actually prolong the usefulness of the site as grouse cover since the shrub understory will probably provide sufficient cover well beyond the time that natural thinning of the aspen would reduce aspen stem densities below acceptable levels.

Perala and Laidly (1989) have created this apparently favorable situation through a nitrogen-fertilized aspen thinning treatment near Toivola, about 40 miles northwest of Duluth, Minnesota. On this site, visited as a part of this Symposium activities, the understory vegetation in the thinned area provided a quality of grouse habitat judged to be quite superior to that persisting in the nearby unthinned aspen stand.

If the thinning did not result in the development of an adequate understory shrub growth this loss of habitat could probably be avoided by leaving one 1-acre parcel unthinned in each 10 acres. As I have noted earlier, ruffed grouse do not need extensive areas of cover of the proper density, but they appear to need at least one acre in each activity center to provide security. This does not have to be aspen, but aspen cover is clearly preferred. Acceptable densities for alder or even hardwood regeneration are the same as for aspen, but if the shrubs are hazel or species having similar growth form, densities should be 3 to 4 times those given for aspen (Cade and Sousa 1986).

MANAGEMENT APPLICATIONS

The forest manager involved with aspen management can prescribe ruffed grouse abundance for the next two decades, or longer, by how he or she plans aspen harvesting and subsequent treatments. More than a quarter-century of experimentation and documented aspen response shows that this can be done with a high level of confidence, at least in Minnesota forests.

While various embellishments can be incorporated to satisfy various aesthetic needs, the basic factors are proper-sized clearcuts interspersed in space and time to continually provide critical food and cover within acceptable foraging distances.

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